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(54) An electronic loudspeaker system having a harmonious sound with multiple adjustable sound levels.

(57) An electronic loudspeaker which comprises a characteristic wave shape generator, an attenuator, an amplifier, a loudspeaker and a controller, is designed on the basis of the principle of harmony and acoustics; the loudspeaker according to the invention has multiple and adjustable sound levels; it can give out alarming at multiple adjustable sound levels and give instructions in an analogous human voice when a vehicle is turning a corner, or moving backward, it also can be used as a microphone for public addressing. Because of its multifunction, low voice pollution, and a long service life, it is suitable for various transport means for a safe driving, and it also can be used for alarming purpose in other cases.

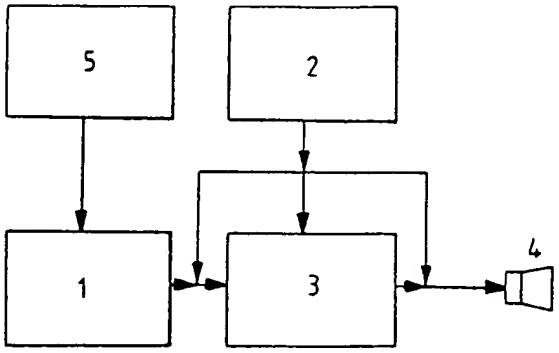

FIG.1

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AN ELECTRONIC LOUDSPEAKER SYSTEM HAVING A HARMONIOUS SOUND WITH MULTIPLE ADJUSTABLE SOUND LEVELS

The invention relates generally to an improved electronic loudspeaker system for vehicles and other transport means, and more particularly to a kind of longlife and multifunctional electronic loudspeaker system which can reduce noise pollution and is beneficial to safe driving.

The safe driving alarm for the existing transport means are generally a kind of electromagnetic membrane vibration sounder which comprises an alloy membrane, tungsten contacts, an electromagnetic coil, a yoke and a steel echo plate. However, the sound level of this kind of loudspeaker is very high and unadjustable, and the said metallic contacts have low reliability. Furthermore, the sound of this kind of loudspeaker is very noisy and irritating, thus, the defects of these loudspeakers are noise pollution and short operating life.

Since the said kind of electromagnetic loudspeaker has the above mentioned defects, it is being replaced by a new kind of electronic loudspeaker in many fields. Up to now, these are three kinds of electronic loudspeakers. The first kind of which is composed of an oscillator, a power amplifying circuit, an electromagnetic coil, a yoke, and a steel echo plate. However, this kind of electronic loudspeaker has such defects as unadjustable sound level, piercing sound, high power consumption and only a single function. The second kind is an alarm megaphone used for special-purpose vehicles, comprises an oscillator, an amplifier and a tweeter (such as the product made by the Changhong Machinery Works). However, this kind of loudspeaker which can only be used as an alarm for a police car or an ambulance is not suitable for general transportation means, and it is also bulky and of high cost. The third kind, which comprises a counter circuit connected to a single oscillator, is a large-sized two partial-tone loudspeaker (see Belgium patent application No. 848315). The said loudspeaker sends out a sound at only two alternate frequencies, and the tone of that sound is similar to that of an alarm, thus, it is not suitable for use as an auto horn.

To overcome the above-mentioned defects, the present invention provides a new kind of electronic loudspeaker which is designed on the basis of the principle that the tonal quality of a sound bases on its frequency and the shape of the envelope curve of the sound wave amplitude, and made by applying electronic techniques. The sound of this kind of electronic loudspeaker for safe driving is characterized by a rich and harmonious timbre and multiple adjustable level. The present invention also provides this kind of electronic loudspeaker with multifunctions by applying electronic techniques. Thus, the loudspeaker, in accordance with the present invention, can sound an intermittent alarm when a vehicle moves backwards or give out a low level sound at different frequencies to indicate the direction of advance when the vehide turns right or left; and it can also be used as an alarm for special vehicles (such as a police car) and as a megaphone and so on. With some modifications on the circuit of the loudspeaker of the present invention, the loudspeaker can give many instructions in an analogous human voice during a drive.

The above description, as well as further objects, features and advantages of the present invention, will be more fully understandable by reference to the following description of the present preferred embodiments in accordance with the invention and the accompanying drawings, wherein:

Fig. I is a block-diagram illustrating the principle of the invention.

Fig. 2 is a schematic diagram illustrating an improved loud speaker according to the present invention.

Fig. 3 illustrates a circuit used for the preferred embodiments of the invention.

With reference to Fig. I, the system of the invention comprises: a characteristic wave shape generator (I); an attenuator (2); an amplifier (3); a loudspeaker (4) and a controller (5). The said characteristic wave shape generator (I) is used for generating, on the basis of the driving conditions of the vehicle and its driver, a regular periodic signal which has various composite frequencies and different shapes of envelope curves, i.e., different characteristics, in order to generate a sound with a certain tone or a sound imitating the music of a stringed instrument or an analogous human voice. These functions can be achieved by using one of the following methodes, one of which is provided with several independent oscillators, a mixer and a wave amplitude superposed circuit, wherein some of the said oscillators constitute a tone control oscillation circuit, the oscillatory frequency and wave shape of which are determined upon the variation of the tones of a tremolo or various alarms. Besides, some oscillators constitute reference frequency oscillation circuits, the frequencies of which are modulated by the output wave regulation of the said tone control oscillation circuit. The said reference frequency oscillation waves are applied to the said mixer and wave amplitude superposes circuit for composite. Thus, under the control of the controller (5), signal waves with different characteristics are generated. In another method, a

clock oscillator is provided for generating a clock signal; and several delay elements, frequency dividers, mixers and modulators are provided for shifting the phase, dividing the frequency, mixing the frequencies and modulating the wave amplitude of the said clock signal respectively. Under the control, being effected through a controller (5), of a driver switch and a driving state switch, signal waves of various characteristics are generated. In the last method, a syntherized music/human voice integrated circuit is provided for generating characteristics waves under control of a driver switch and a driving state switch. For the characteristic waves of an alarm, it requires that every single frequency of the frequency mixing signal should be stable. Moreover, they are in conformity with musical theory and the rule of harmony; it should be noted that, during a selection of the single frequency, the different beating frequencies of the signal of every single frequency should also conform with the rule of harmony. The shape of the envolope curve which determines the tonal quality of a sound is selected upon the desired harmony. The content of a human voice depends on the requirements of the function, where the frequency of a female voice or a chird's voice is applied. The function of the attenuator (2) is for achieving adjustable and multiple sound level in the following ways. In one of them, the said various characteristic signal wave outputs from the said characteristic wave shape generator are applied to the amplifier (3) through several voltage-dividing resistors, wherein the attenuation rate of the attenuator is determined by the resistance of the said voltage-dividing resistors. The attenuation rate of alarming can be controlled by a driver function switch in order that the sound level can be adjusted, and the attenuation rate for other functions can be adjusted upon a national standard. In another way, several voltage-dividing resistors are inserted between the amplifier (3) and the loudspeaker (4). In a further way, the feedback signal from the amplifier is controlled, and an attenuator is incorporated in the feedback circuit of the amplifier, wherein the said amplifier is made of either discrete compounds or an integrated circuit. The impedance of the voice coil of the loudspeaker (4) is 2-8 Ω , the standard output power is 5-12.5W. The choice of the said data is made upon the voltage of the power supply and the highest sound level of a loudspeaker. It is necessary to use a high frequency horn loudspeaker, in an environment with a high sound level (about 100-110 db), but its structure needs to be improved by the following measures: the length of the horn loudspeaker should be shortened to $\frac{1}{2}$-$\frac{1}{4}$ the size of a 5W horn loudspeaker available in the market. The magnetic material and pole shoe are attached to each other by a non-magnetic metallic or plastic reinforcing clamp ring after being glued to each other by a strong adhesive originally used, and they can also be supported by a non-magnetic metallic fastener for a high vibration strength. If only used in an ordinary enviroment with a sound level of less than 95-100 db, the loudspeaker can be either a horn loudspeaker or an improved cone loudspeaker. When the latter, i.e., an improved cone loudspeaker, is adopted, it should be set in a reflecting cavity (please refer to Fig. 2 which shows the structure of the reflecting cavity.). With reference to Fig. 2, the distance between the supporting member (7) of the cone of the loudspeaker and the bottom of the reflectinf cavity (6) is 6-10mm, the distance between the rim of the of the said supporting member and the side wall of the said cavity is 10-15mm, and the depth of the said cavity is similar to the axial length of the loudspeaker therein. The diameter of the said supporting member of the cone is 60-100mm, the impedance of the voice coil is 2-8 Ω , the standard output power of the loudspeaker is 3-10W. The improvments made in the cone loudspeaker include that a light-textured and heat-resistant (up to about 120°C) semi-hard plastic membrane (such as polypropylene) is used for the cone, instead of the original material; and a rubber-coated fabric is used as a folding material. The controller (5) comprising several logical circuits and electronic switches for signal distribution is controlled by a driver operation switch and a driving state switch. The controller, according to the requirement of various functions, selects a characteristic signal wave output from the said characteristic wave shape generator (1), and sends it to the amplifier (3). When a microphone and a preamplifier are connected to the inputs of the said amplifier, the system of the present invention can be used as a public-addressing system under the control of the said controller (5). An indicating lamp connected to the driver operation switch (sound level control switch) will turn on when the sound level of the loudspeaker is very high. The said indicating lamp may be mounted on the front of a loudspeaker, so that a policeman can monitor the sound level of the loudspeaker of a vechical, thus, noice can be controlled easily.

Comparing with the prior art, the loudspeaker of this present invention, which can be operated for more than two million times, is power-saving and long-lasting, and its sound level is adjustable, its tonal quality is harmonious, it also can speak in a human voice, thus, it can effectively reduce environmental noise pollution.

Comparing with the existing electromagnetic viberation loudspeaker used at present, the loudspeaker of the invention is material-saving and has multiple functions convenient to a safe driving, and

it can operate in a bad air condition, therefore, it is suitable for use as a safe driving alarm or a warning indicator, for various transport means it also can be used as alarm indicator in other cases.

Shown in Fig. 3, it is a preferable embodiment of the present invention. Referring to Fig. 3, inverters FI and F2, resistors RI and R2, and capacitor CI constitute a tremolo oscillator with a oscillatory frequency of 8-9Hz. Through an integrating circuit constituted by a resistor R3 and a capacitor C2, a sawtooth wave output is generated which has a peak voltage (Vpp) of 0.5-2V. Through an isolation resister R4 (about IM Ω), the said sawtooth wave output modulates the oscillated wave in the main oscillation constituated by inventers F3 and F4, resistors R5 and R6, and a capacitor C4. The oscillated wave output from the inverter F4, through a first integrating circuit (constituted by an inverter F5, a resistor R7 and a capacitor C3) and a second integrating circuit (constituted by an inverter F6, a resistor R8 and a capacitor C5), drives two frequency dividers respectively. One of the said frequency dividers is constituted by a NAND gate YI, an inverter F7, a resistor R9 and a capacitor C6, and divides the frequency of a input signal by two. The other one is constituted by a NAND gate Y2, an inverter F8, a resister RI0 and a capacitor C7, and divides the frequency of a input signal by three. At the outputs of the inverters F7 and F8, a oscillated wave output with a frequency of 600Hz and 400Hz are generated respectively. The said outputs are mixed and amplified through resistors RII, RI2 and RI3, a capacitor C8, resisters RI4, RI5 and RI6, and a transistor GB, so that a frequency mixing wave with a difference frequency of 200Hz is generated. The shape of the envolope curve of the said frequency mixing wave can be approproiately adjusted by adjusting the value of R7, R8, RII, RI2, C3 and C5, thus, various timbre can be obtained. An oscillator with an oscillation frequency of 0.5Hz, is constituted by a NAND gate Y3, an inverter F9, resistors R22 and R23, and a capacitor CII; and is controlled by a terminal H. The output from the interver F9 of the said oscillator controls and electronic switch S4 for obtaining an intermittent signal wave to alarm the moving back of a vehicle. The operating point of a microphone WD is determined by a resistor R26. Bidirectional electronic switches SI, S2, S3 and S5 are controlled, respectively, by input control terminals A, F, E and G which are connected to four function-selection switches for driving alarm, indicating right turn, left turn and for public addressing. When any one of the said five terminals is connected externally to a high level (VDD), the impedance of the corresponding electronic switch will become low from high state immediately. When the value of the function, and sound level adjusting resistors RI7, RI8, R20, R2I, R24 and R25 are appropriately adjusted, various levels can be obtained at the input terminal of the power amplifier FD, wherein the said resistors RI7 and RI8 are also connected externally to the terminals B, C and D. The composition of the short circuit of the said three terminals results in four different attenuations, so that the sound level can be adjusted. A voltage regulator comprising a resistor RI9 and a voltage regulator tube D6 with an output voltage VDD supplies power to all branch circuits, except the power amplifier FD, whose power source is supplied by external switches isolated by the corresponding diodes DI-D5. The power amplifier FD is a kind of power amplifier intergrated circuit available in the market. Shown in Fig. 3, C9 is a blocking capacitor, CI0 is a bypass capacitor for preventing the power amplifier FD from self excitation, and CI4, CI5, CI6 and CI7 are feedback capacitors. Resistors R30, R3I, R32 and R28, and capacitors CI2 and CI3 are used for stablizing the operation point of the circuit. By adjusting the value of the resistor R6, a satisfactory frequency of the said main oscillation can be achieved, so as to obtain a satisfying harmonious sound effect. Either one small-type horn loudspeaker LD or more can be used in the present invention.

It will be more clearly appreciated that numerous other embodiments, variations and alterations in the present invention can be made without departing from the spirit and the scope of the invention as herein described and illustrated. Consequently, it is the objective of the following claims to encompass all such modifications and variations as fall within the true scope of the invention whether or not such variations or modifications have been specifically described in conjunction with the above illustrative embodiments.

Claims

I. An electronic loudspeaker system, which is mounted on transport means for a safe driving, characterized by comprising:
a characteristic wave shape generator (I);
an amplifier (3);
an attenuator (2);
a loudspeaker (4); and
a controller (5);
wherein the said characteristic wave shape generator (I) is connected to the amplifier (3); and the attenuator (2) drives the loudspeaker (4) under the control of the controller (5), the said loudspeaker has multiple functions and a harmonious sound, and its sound level is adjustable.

2. An electronic loudspeaker system, according to the claim I, characterized in that the said characteristic wave shape generator (I) comprises several independent oscillators, a mixer and a wave amplitude superposed circuit, wherein some of the said oscillators constitute a tone control oscillation circuit; the other oscillators constitute reference frequency oscillation circuits; the said tone control oscillation circuit modulates the frequency of the reference frequency oscillation circuits; and through composite by the mixer and the wave amplitude superposed circuit, generate various characteristic signal waves under the control of the controller (5).

3. An electronic loudspeaker, according to claim I, characterized in that the said characteristic wave shape generator (I) comprises a clock oscillator and several delay circuits, frequency dividers, mixers and modulators for shifting the phase, dividing the frequency, mixing the frequencies and modulating the wave amplitude of the clock oscillation wave from the said clock oscillator; and under the control of a driver operation switch and a driving state switch, being effected through the controller (5), generates various characteristic signal waves respectively.

4. An electronic loudspeaker system, according to claim I, characterized in that the said characteristic wave shape generator (I) comprises a synthesis music/language integrated circuit, and generates various characteristic signal waves under the control of a driver operation switch and a driving state switch.

5. An electronic loudspeaker system, according to claim I, characterized in that the various characteristic signal waves from the said characteristic wave shape generator (I) are applied to the input of the amplifier (3) through several voltage-dividing resistors, wherein the attenuation rate is determined by the specific value of the said voltage-dividing resistors.

6. An electronic loudspeaker, according to claim I, characterized in that several voltage-dividing resistors are inserted between the amplifier (3) and the loudspeaker (4).

7. An electronic loudspeaker, according to claim I, characterized in that the feedback of the amplifier (3) is controlled; the attenuator (2) is incorperated in the feedback circuit.

8. An electronic loudspeaker, according to claim I, characterized in that the loudspeaker (4) is a horn loudspeaker.

9. An electronic loudspeaker, according to claim 8, characterized in that the inpedance of the voice coil of the loudspeaker (4) is 2-8 Ω , the standard output power is 5-I2.5W, the length of the horn loudspeaker is about $\frac{1}{2}$-$\frac{1}{4}$ of that of a 5W horn loudspeaker available in the market, the magnetic material and pole shoe are attached to each other by a non-magnetic metallic or plastic reinforcing clamp ring after being glued to each other by a strong adhesive originally used.

I0. An electronic loudspeaker, according to claim I, characterized in that the loudspeaker (4) is an improved cone loudspeaker.

II. An electronic loudspeaker, according to claim I0, characterized in that a light-textured and heat-resistant (up to about I20°C) plastic membrane is used for the cone, instead of the original material, and a rubber-coated fabric is used as a folding material, the inpedance of the voice coil is 2-8 Ω , the diameter of the supporting member of the cone of the loudspeaker is 60-I00mm, the standard output power of the loudspeaker is 3-I0W.

I2. An electronic loudspeaker, according to claim II, characterized in that the improved cone loudspeaker is set in a reflecting cavity (6), the distance between the supporting member (7) of the said cone of the cone loudspeaker and the bottom of the reflecting cavity is 6-I0mm, and the distance between the rim of the said supporting member and the side wall of the said cavity is I0-I5mm, and the depth of the said cavity is similar to the axial length of the loudspeaker therein.

I3. An electronic loudspeaker, according to claim I, characterized in that an indicating lamp is connected to the driver operation switch (sound level control switch), and the said indicating lamp which is mounted on the front of the loudspeaker will turn on when the sound level of the loudspeaker is very high.

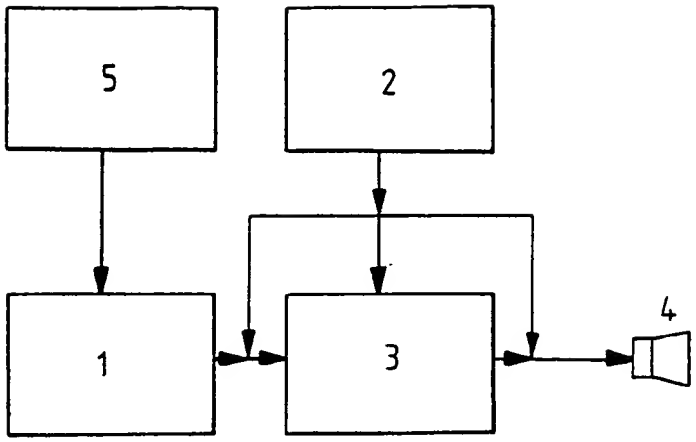


FIG.1

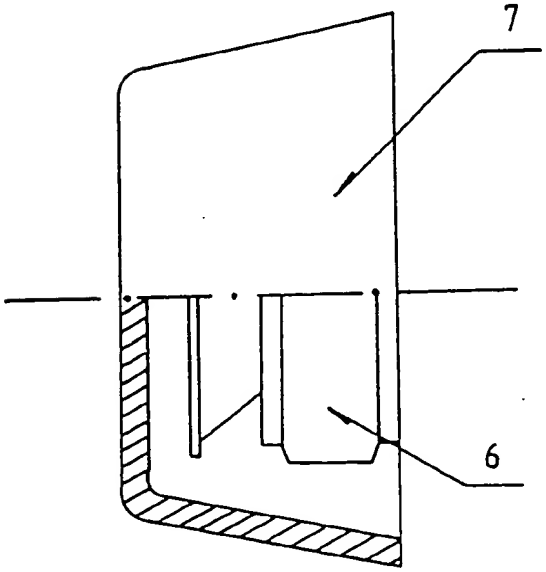
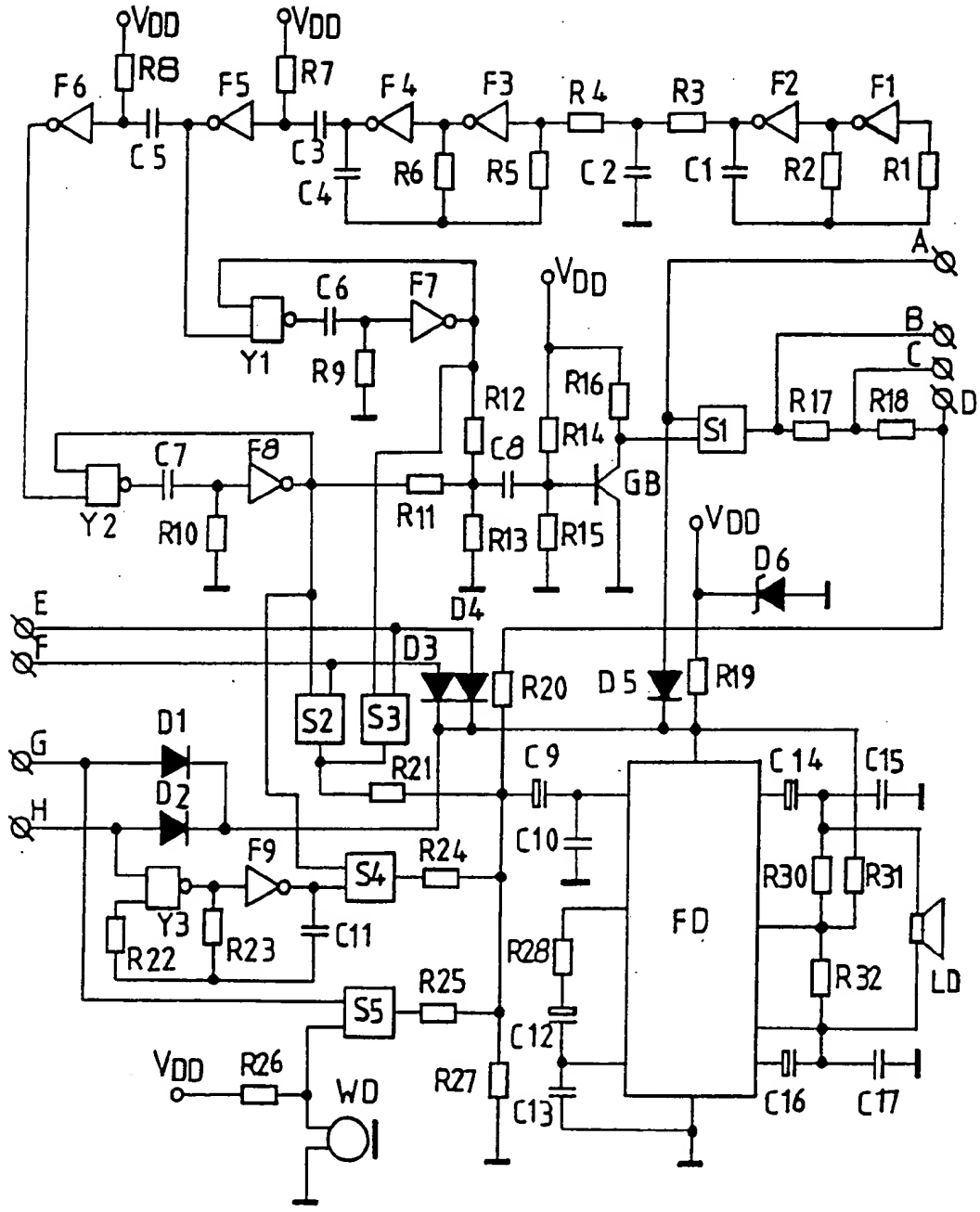


FIG.2


VDD
VDD
R8
R7
F6
F5
F4
F3
R4
R3
F2
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C5
C3
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R5
C2
C1
R2
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A
C6
F7
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R17
R18
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C7
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R14
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LD
R25
S5
C12
VDD
R26
WD
R27
C13
C16
C17

FIG.3